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## ABSTRACT

The problem of old and obsolete school facilities is acute, particularly in large cities. A maintenance or rehabilitation oriented approach is not a realistic answer to continued facility usage. Guidelines show that if the cost of modernization for an additional life of 20 to 30 years approaches 50 percent of the estimated cost of replacement, project practicability should be questioned. Several examples of realistic modernization programs are shown in which emphasis is placed on new functions and activity relationships. The answer to the problem might be found in utilization of advancing technology. Old buildings should be developed as supporting facilities for a flexible system of readily transportable learning environments. Current development of such a system is traced from the project's inception. (MH)

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A GEOMETRIC APPROACH TO SCHOOL MODERNIZATION.

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Back in 1857, a new school building was dedicated in a fast-growing section of one of our large Eastern cities. All of us have driven by a similar school and, those of us involved in education would not be surprised by the floor plan. Three years after this school was occupied, Abraham Lincoln became the president of the United States.

The dedication of this school, and the many more just like it (with minor exterior decoration changes) may seem a bit of interesting, but unimportant, information, until we realize that in 16 of the Great Cities of the United States there are still almost 600 elementary schools and more than 50 junior and senior high schools put in place before the end of the 19th century <sup>and</sup> still in use today.

If we move into the present century and take the period 1901-1920, we find still in use 722 elementary schools and 165 junior and senior high schools--almost 900 separate school buildings. These buildings all appear pretty much alike with floor plans following a pattern familiar to all of us.

Now if we total our Abe Lincoln and Teddy Roosevelt eras we find approximately 1300 elementary schools and more than 200 junior and senior high schools--a total of more than 1500 separate buildings still in use that were put in place before commercial air travel, television, sound motion pictures--many of them before the invention of the electric light bulb or the automobile.

Just think of it--in 15 of the Great Cities of this country 12 1/2 percent of all public school buildings were put in place prior to 1900; more than 36 percent before 1920. The first national inventory of school facilities conducted by the U.S. Office of Education, reported that nationally 30,000 public school

buildings and additions containing some 250,000 classrooms have been in use for more than 50 years. These classrooms represent almost one-sixth of all permanent instructional areas. In addition there are 42,500 classrooms in 5,000 non-public school buildings which have been in use since before 1920. If we start adding the general-use facilities as reported by the national inventory we begin to get staggering figures--28,000 school libraries, cafeterias, auditoriums, and gymnasiums in public schools and more than 8,000 such facilities in non-public schools in service for 50 years or more!

But nowhere is this problem more acute than in the large cities. The age profile of the Buffalo, New York, schools is fairly typical of that found in any large urban area. The schools still in use span a building period of 103 years!

It should be stressed that these statements are in no way an indictment of the work being accomplished in the large cities school districts. In the field of school facilities, the large metropolitan school districts are accepting a role of leadership in educational planning to meet the challenges of today. They are doing an amazing job as a matter of fact with the way neighborhoods are changing or destroyed by shifting populations and that coverall approach we call urban renewal. But the fact has to be faced that hundreds--yes, thousands--of our children attend schools which time has passed by.

Now, for a moment, let's move up to the late 1920's and mid 1930's. Some will say we have progressed, but things look pretty much the same. You will note this particular floor plan looks a little bit different. I took the plan from one of the more progressive districts where they are trying carpet on the floor

and have knocked down a wall to expand the library.

It was about the time our friend here was built--about 40 years ago, by the way--most of the schools built prior to this time were put on replacement lists. Our attitude toward children was changing somewhat and it was the hope to gradually replace some of the older plants. Once they were put on this list, little except preventive maintenance and safety revisions were accomplished. But the best laid plans--suddenly we were in the 1940's and school construction slowed and then halted. Our old friends on the replacement list bowed to the war efforts and all we could do was dream of the great tomorrow.

The war ended and we tried to get back to normal, but found ourselves faced by the post-war baby boom. As we built we realized we couldn't tear down our replacement list buildings. There simply wasn't--and I probably should add, isn't--enough money to give all our children schools planned specifically for today's changes in education.

At one of the first meetings scheduled on the subject as part of the "New Life for Old Schools" study, representatives from member cities discussed the aspect of the old school problem. A few quotes from that meeting help to point up the dilemma of the old city schoolhouse:

"Our story is the same as in many other cities: heavy growth in concentrated periods and only enough money to meet the demands of new population growths, but never enough money to replace or modernize obsolescent school building."

"Fifty-nine buildings, or 29 percent of our total school plants, were constructed prior to the turn of the century, and eighty-five buildings, or approxi-

mately 41 percent were constructed prior to World War I."

"Since most of the buildings requiring modernization and/or improvements are within the so-called inner-core or inner-city, a section which no longer has community ties and traditions because of population change and mobility, we are faced with a very real problem in human psychology."

"The school plant has suffered because of inadequate funds. Extraordinary repairs have had to be curtailed, and many major educational projects have been postponed year after year, because of lack of funds."

"It is evident that, until greater resources are available for capital expenditures and/or the need for providing for new construction to meet pupil enrollment demands diminishes, we must necessarily conduct a restricted program for systematically modernizing school facilities."

"The young teacher-graduates of modern colleges and universities... expect and seek fully equipped, well-designed, up-to-date classrooms in which to pursue their life work... Their talents are ill-used when they must handle classes of forty-to-forty-five in outmoded buildings with inadequate facilities. As a result, many have left such conditions to move into suburban schools."

"Some of our older schools were on sites having less than thirty-five square feet per pupil of play space."

So today we find ourselves faced with old schools getting older. On top of this we have our 1930 schools--still good structurally--being left behind by advancements in educational philosophies and methods. But who among us could say, We could have planned a school in 1930 to meet the challenges of today?



Some of these older buildings continue to say "education is important". Almost all of them have some shortcomings as viewed next to the newer schools planned around and for changing educational programs.

In many cases the administration five, ten, fifteen years ago surveyed the system and marked certain buildings for replacement or abandonment. In too many cases this simply has not happened. The children keep coming, and the building scheduled for replacement continues to operate with the hope that in a few years "the old dog" can be given a quick, but decent burial. In some cases, hopefully, this will happen! In too many instances, it will not because one of the problems of the central city is that even as total population decreases, school population continues to increase. One Great Cities' superintendent states that the way it's working out right now, they have about one additional student for every net decrease of one person. And this is typical of many other cities. And, as one board member in New York said, "If you don't have seats for children, you simply have to keep the old building."

And we are keeping them. We are expecting these 30,000 school buildings in use for 50 years or more to continue to serve us when we are told that a typical family living the year 2000--33 years from now--may go to school for only part of their education and for the rest receive televised instruction directly from a central computer. Our libraries may be fully automated and important targets for queries from home, and so on.

Faced with this technology, too many modernization programs are really simply maintenance or rehabilitation approaches, changing the green walls

to yellow, adding some asphalt tile to the floor--preferably the kind heralded by the manufacturer as "maintenance free"--changing the incandescent lighting fixtures to fluorescent ones, putting acoustical tile on the ceiling of classrooms and, if the budget permits, in the corridors.

When we're finished the classrooms are still the same size dictating the educational program possibilities. The "administrative suite" may be a little more spacious, but just as inconvenient when it comes to conferences with parents or other trouble makers.

We have spent our money locking the old school right back into its egg crate restricting new and imaginative educational approaches. The sixteen member cities of the Great Cities Research Council recognize the problem, and motivated by the urgency of attracting and holding qualified teachers as well as providing suitable environments for their children, in 1965, under a grant from EFL, started a study on what can be done to give new life to old schools.

By the way, if we want to translate the statistics mentioned at the beginning of these remarks into dollars and cents, we come up with incentive figures for manufacturers to join the development of new products for modernization. We have 250,000 classrooms in use today that are considered inadequate by present day standards. If we use an estimate of \$15,000-\$20,000 per classroom--(50% of the cost of replacement) for modernization, it would require about \$5 billion to modernize the classrooms alone--we aren't figuring the general-use facilities. If we assume half of these classrooms should be replaced we still have an impressive figure--about what it would cost to develop a new



giant commercial airplane or a month's expenditure in Viet Nam.

So what's to be done?

The Great Cities have long recognized the old school problem and in February of 1965, The Research Council of the Great Cities Program for School Improvement announced a grant from the Educational Facilities Laboratories for a study of the problems connected with the modernization of outmoded school plants. Each city is represented in the study by a staff member.

The signature slide you see is actually the cover from the first publication in the spring of 1965 defining the problem and stating the existing modernization programs in the then 15 participating cities. This book is now in its second printing and is still requested by school districts everywhere facing modernization problems.

We have sponsored a series of conferences to explore creative solutions to the problem plus an airborne tour of school modernization projects in four states and Canada. This trip became the subject of a 20-minute, color sound motion picture. The film is available for general distribution.

One of the guidelines we have agreed upon in our Great Cities study is that if the cost of modernization approaches 50 percent of the estimated cost of replacement, it is wise to take a second look. This is based on a projected additional life of 20-30 years.

So where does this leave us?

In all our meetings we have agreed to continue to search for guidelines to determine when to modernize, but we have agreed it is more important to develop creative ideas on how to modernize.

We have stated that age is not necessarily the criteria for obsolescence. We are considering buildings which (1) even though recently constructed are rendered antiquated by the explosion of knowledge and changes in program, and (2) are older but time, as well as program, have passed by.

With this how approach as a background, in September of 1965 we began publication of a periodic newsletter and the October issue will be number 22 of that series. Incidentally, in addition to distribution to the Great Cities members, the Newsletter is mailed to about 1500 architects and educators.

As we developed the study and became more impatient to move into an action phase, we announced a series of architectural competitions and design fetes to help turn a creative spotlight on the problems of the outmoded school plant.

The first action event was an architectural competition for the modernization of the famous Hyde Park High School in Chicago. It was concluded in Chicago the spring of last year.

The first award winning design by the architectural firm of Orput-Orput & Associates distinguished itself by structuring in its plan, combinations and relationships of activities with minimum effort of major reconstruction. The result offers the possibility of functions and programs beyond those envisioned today. In fact, it demonstrates a wider range of usability with reasonable economy of effort than realized in many new school facilities recently constructed.

In Pittsburgh we have just completed a little different approach. Working with the Department of Architecture, Carnegie Institute of Technology, we

brought in six visiting architects, --all considered experts in the field of educational facility planning--to work with the students on the modernization of two existing schools. One was the Liberty Elementary School--of late 1930 vintage--and the other the Wightman Elementary School--built more than 50 years ago.

Our second competition was completed in May of this year in New York City. When we announced the event 582 architects or firms registered with almost 70 actually completing work required for consideration by the jury. The winning design was the work of Frederick G. Frost & Associates.

~~This Fall we hope to announce competitions for schools in Boston and Baltimore.~~

P Several other cities are working with the Council on plans for special school modernization approaches.

But as we work on these events and programs, we are beginning to ask ourselves if, perhaps, we cannot go beyond the more traditional approaches to modernization. Is it practical to use old methods on old buildings, or should we be looking for entirely new approaches?

Too often we find ourselves slowed, or actually stopped, because there is no available product to solve the problem facing us. Is it not possible to determine what new product performance characteristics are necessary to improve this process of modernizing old schools. Once we have this information, it is our intention to assist industry in its efforts to provide school systems with products that will make it possible for old school facilities not only to be brought up to date educationally, but also to be able to remain up

to date as new technology emerges. This sounds like a big order and it is. But we look forward within the next year to development of a set of specifications of need.

Then we are intrigued by events such as the "Design-in in Central Park." Here was a group concerned with environment deciding that an environment-- in this case for a conference--could be created overnight in the middle of New York City. The Central Park strollers were fascinated as they watched air structures and geodesic domes go up as housing for the conference. The press was frustrated in the inevitable search for "something new." The components used there were all things existing--some for many years. Perhaps the most significant statement to emerge from the Design-in was the real question: Are we using to advantage the technology already available to us?

Could we apply some of this technology to our school modernization problem. For instance, let's say we use an air structure on or near the site of a school to be modernized. Inside the school we could put the paper houses currently in use in such areas as migrant worker housing in California. Using these inexpensive structures we could create an "educational village under a dome" accented with the necessary mobile laboratories available today. The result would be that all of our children could be moved out of the school into the "educational village under the dome" and the contractors would have uninterrupted access to the building to be modernized.

With the "empty building" incentive, could we cut down the time needed for modernization? Would this not mean a savings in construction cost? A possible

schedule would be to move the children into the dome village immediately following the December holiday vacation with the goal of moving them back into their modernized school the following September. If a slum building can be modernized over a weekend, is it possible to modernize a school over a six-to-seven month period?

Approaches like this have led us to ask if there is another way of looking at the entire concept of school modernization. We are working on an approach that is, at this time, still in the first stages of development and the remarks about it must be taken as preliminary. The first public announcement of the project was made at the "Schoolhouse in the City" conference in Palo Alto this past July. This was followed by reports in our Newsletter which resulted in interest being expressed from many and varied sources.

We are operating with the knowledge that when a school needs modernizing one of the problems is where to find additional space. New teaching techniques, the need for large, medium and small teaching spaces, the expansion of the library, physical educational, and other supporting facilities usually dictates the need for additional classroom space. School districts are often reluctant to invest too much of an expenditure in thoughtful and complete programs based on another 20 years or so of life for the old structure.

One possibility is that the old building should be used for the supporting services. The utilities are in, the space is there. We refer to this concept as Project Tactics--translated this means "Technological Architectural Coordination To Improve City Schools." This is a geometric approach to school modernization and addition.

We recognize that the evaluation of the existing plant for preservation and its subsequent modernization to meet the very same educational goals and program as any new school is one crucial aspect of the general problem that needs to be met squarely. Nevertheless, increasing enrollments and population mobility with the corresponding shifts that can and do occur suddenly--often over summer, unnoticed, unforeseen--place tremendous burdens on the school plant already outmoded. Inefficient utilization of some space while other schools and teachers become overburdened does not contribute to educational vitality, tends to lessen student achievement, and places a burden on the taxpayer's already too small educational dollar.

Secondly, temporary--but highly acceptable visually and socially--educational environments are immediately needed but space is not available in most urban areas to house the displaced students while construction proceeds.

We see the problem as one of designing an evolutionary and totally self-sufficient technological, economic, light-weight and readily transportable "learning-teaching environment." We can further define this educational environmental system as that combination of spatial and technological--that is, fixed and movable--mechanisms and sub-systems which assists and matches the most current educational specification and yet can change its spatial nature at will and with sufficient ease because of its particular structural and geometric order based on simple repetitive units and joining systems.

We propose to design a system, and its sub-systems, which permits spatial flexibility; inter-changeability; quick erection and disassembly; easy



transportability. In addition, we insist that our system be esthetically acceptable, and, even more importantly, be able to be combined to create various-sized teaching spaces for complete flexibility in educational approaches. This demands a broad design approach which necessitates the involvement and coordination of experts from a wide variety of fields. This integrative approach to design requiring that the system as a whole function in the most efficient manner, thereby will necessitate certain compromises between various components or sub-systems contributing to the final solution. Therefore, the functioning of any one component would not be taxed to the maximum, but at most would be required to give optimum service only in terms of the total system and its education<sup>d</sup> and social goals.

To develop this concept we are currently working with the Chicago architectural and engineering firm of Metz, Train, Olson & Youngren, Inc. We know our goal, but to help us arrive at the end product, we have developed a preliminary network of relevant and hierarchical decisions. This is the type of programming which is used to guide the design approach for an atomic submarine or industrial complex--why not apply it to our modernization problem and, specifically, to PROJECT TACTICS?

Now I imagine that many of you were not able to read these network charts as shown on the slides. To make it easier for you we have prepared a blow-up of one of the charts which will explain a little clearer our approach.

Some of the questions we are asking are: What can we assume will be housed in the plant? What are the current or emerging educational philosophies

and what are the implications to schoolhouse design? What are the desirable degrees and limits of spatial flexibility, inter-changeability, and expansion? What are the desirable limits of assembly heights and variations? At what production and/or fabrication levels does the system become competitive with conventional construction irregardless of speed or other assets of system? What are the proper esthetic criteria to make the systems more acceptable to the neighborhood it serves? How can the system relate most effectively to the existing school? What about labor or trade-union problems? Transportation? Safety and fire requirement differences in various parts of the country? What size of market must we guarantee before private industry will be interested? Once the system is produced in mass, how is it made available to schools--via a national leasing system? By direct sale? What are the storage considerations of the systems if nationally leased? Is the system valuable to adaption to site variations?

The technique of using building components to create environment is not new. One of the first stages of the investigation of utilizing this approach for additions and modernizations is a study of the advantages and disadvantages of current repetitive unit systems such as SCSD, Habitat 67, metal container manufacturers for shipping, trucking, and flatcar railroad interchangeability, the various vacation house approaches, and so on.

Should the system be suspended from a utility tower with the units added and subtracted as enrollments and programs demand, or should it be slipped-in to a frame-work, or stacked one on top of another? Or is there another way of

approaching the solution to the problem? These are the questions to be answered, but whatever the final recommendation the geometric systems must be highly acceptable visually and socially, capable of quick erection and disassembly, and capable of spatial change for today's rapidly changing education, all at a realistic cost.

The list is lengthy, but once we have the answers to these and other questions, it is our goal to design such a system which is used in conjunction with an existing structure. We see the individual units added or subtracted to meet enrollment needs. We anticipate the existing structure would be modernized to house supporting facilities--auditoria, cafeteria, gymnasium. Or, if the situation indicated the developed units would be combined as gymnasium, cafeteria, or whatever space is needed.

We intend to build a prototype in combination with the modernization of our existing structure. This end product of Project Tactics would then be tested under actual construction and pupil use. The challenge is exciting; the potential is great.

We have had a series of meetings with other persons working on systems developments. In one of these meetings, which took place in Chicago earlier this month we were reminded that our main problem is to think in terms of those 250,000 outmoded classrooms we mentioned earlier. This has led us to ask if it is possible to design a mechanical systems which could be utilized in the old structure as well as our geometric additions.

We now have our theory. Our architectural consultants are continuing their

preliminary thinking and planning. Next month we will bring together in Cleveland the school facilities directors from each of the 16 Great Cities. With them we will review our progress to date and find out what the man on the firing line--the man who has to make the decisions within these cities--thinks of Project Tactics. We know that no one approach is right for all situations. That is why the Great Cities instituted the "New Life for Old Schools" study. We will continue to search for creative solutions to the problems of the outmoded school plant long after this study is completed. But we believe one of the main problems of modernization is that now we start with something old.... perhaps the solution is to start with something new. And in any society where we can design a combination Hi-Fi, Bar and Fireplace...well it gives us faith.